Minutes of Meeting #11 of RTCA SC-186 Working Group 3
Development of Revision A of the ADS-B 1090 MHz MOPS
http://adsb.tc.faa.gov/ADS-B/186-subf.htm

The meeting was called to order by Dr. Vince Orlando at 9am on 14 May 2002, at the conference room facilities of Titan Systems in Mays Landing NJ, hosted by Gary Furr of Titan Systems and the FAA Technical Center. Dr. Orlando welcomed all attendees and asked that each attendee introduce themselves and their organization. The attendees included:

Gary Furr, Titan Corp, FAA TC - ACT-350	Ron Jones, FAA ASD-140	Stuart Searight, FAA TC – ACT-350
Bill Harman, MIT Lincoln Lab	James Maynard, UPS Aviation Tech.	Ron Staab, Trios Associates
Carl Jezierski FAA TC, ACT-350	Vince Orlando, MIT Lincoln Lab	John Van Dongen, FAA TC, ACT-350

1. Following the introductions, the following known regrets to attendance were announced:
   - Bob Semar, United Airlines
   - Stacey Rowlan, L-3 Communications

2. Following Agenda Item #2, Vince Orlando made a few introductory remarks regarding the following topics:

   Vince mentioned that Ann Tedford and Costas Tamvaclis are co-chairing an ad hoc committee of representatives from RTCA and Eurocontrol for the purpose of arriving at a standard analysis of the 1090 MHz data link for the purpose of a common expression of range performance.

   Vince mentioned that he had just received a Working Paper .that Australia presented at a recent ICAO meeting in Thailand that proposed requiring the transmission of extended squitters by TCAS equipped aircraft that have GPS onboard. This proposal was made to provide air-ground surveillance in regions of airspace that do not have radar coverage, such as much of the Australian continent.

3. Following Agenda Item #3, the Working Group reviewed the Minutes of Meeting #10 held at the conference facilities of Titan Systems, Mays Landing NJ. Hearing no objection or further comment, the Minutes of Meeting #10 were approved as published.

4. Following Agenda Item #4, the Working Group reviewed the locations, dates and times of the next several meetings, which are scheduled. WG-3 continued to plan meetings through the expected presentation of DO-260A to RTCA SC-186 Plenary as shown in the table below:

Dates/Time	**Meeting Place**
Tuesday, 9 July at 9am through 5pm, Thursday, 11 July 2002	Confirmed to be at MIT/Lincoln Laboratory Aviation Liaison Office, Washington DC Travel info and lodging details are available on the ADS-B/1090 web site
Tuesday, 20 August at 9am through 5pm, Thursday, 22 August 2002	Confirmed to be at RTCA, Washington DC – MacIntosh Room Travel info and lodging details are available on the ADS-B/1090 web site
Monday, 23 Sept at 9am through 5pm, Friday, 27 Sept. 2002	Fall 2002 RTCA SC-186 Plenary confirmed to be scheduled for Monday & Tuesday, 23-24 September 2002, followed by a three (3) day 1090 meeting 25-27 September at Eurocontrol, Brussels Belgium Travel info and lodging details are available on the ADS-B/1090 web site

Dates/Time	Meeting Place
Wednesday, 13 Nov at 9am through 4pm, Friday, 15 November 2002	LOCATION TO BE CONFIRMED Assumed to be at either RTCA or MIT-LL, Washington DC
Tuesday, 10 Dec at 9am through 5pm, Thursday, 12 December 2002	LOCATION TO BE CONFIRMED Assumed to be at either RTCA or MIT-LL, Washington DC
Monday, 27 Jan '03 at 9am through 5pm, Thursday, 30 January 2003	*LOCATION AND SC-186 PLENARY DATES TO BE CONFIRMED* WG-3 meeting on Monday and Tuesday with SC-186 Plenary to approve DO-260A on Wednesday and Thursday

5. Following Agenda Item #6, the Working Group began discussions on Working Paper WP-11-01R1 from Ron Jones, further outlining changes to DO-260 required by the recent approval of the ADS-B MASPS (DO-242A). This Working Paper is an update from changes proposed in WP-10-09. Ron Jones accepted **Action Items 11-05 and 11-06** to continue making changes in this text related to implementing Intent requirements from DO-242A.

6. Beginning with Agenda Item 8, the Working Group began review of several Working Papers from John Van Dongen dealing with Enhanced Processing Techniques. The first Working Paper reviewed by John was WP-11-02, in which he responded to Action Item 10-10 with a detailed description of the re-triggering algorithm used by the Baseline Enhanced Decoder to produce the reception performance shown in Figure 3 of Working Paper 1090-WP-10-16. It was ***agreed*** by the Working Group that John would accept **Action Item 11-01** to propose text for Appendix I based on this Working Paper WP-11-02. Following Working Group discussion on re-triggering, it was decided to modify the text of subparagraph 2.2.4.3.1.2 entitled "**Re-Triggerable Capability**" by replacing the last word in the paragraph with "**processed, and that begins 6 microseconds or later than does the preamble of the message currently being processed.**" AND, by adding a second note below the paragraph with the following text: "*2. Although re-triggering for the case of overlapping preambles is not required, such a capability is desirable. One way to accomplish this is described in Appendix I.*" John further accepted **Action Item 11-02** to propose text for a test procedure for section 2.4.4.3.1.2 for re-triggering.

   Next, in response to Action Item 10-12, John presented Working Paper WP-11-03, which contained the results of running varying position re-triggering tests with the Baseline Enhanced Decoder with the flawed re-triggering mechanism (used to produce WP-10-16 Figure 5). The purpose was to determine the ability of the varying position re-triggering test to reveal the weakness of a flawed re-triggering mechanism. In addition, this Working Paper contained the results of running re-triggering tests with a new Baseline Enhanced Decoder that includes a 6 microsecond dead time whenever it triggers.

   Next, in response to Action Item 10-13, John presented Working Paper WP-11-04, which contained the 6-minute Frankfurt data sample processed with the new re-triggering algorithm and with a 6-microsecond post trigger dead time. The new re-triggering algorithm had virtually no effect on reception, and the 6-microsecond dead time resulted in about a 4% reduction in reception probability overall.

   Next, in response to Action Item 9-10, John presented Working Paper WP-11-06, which presented 1090 Extended Squitter reception data from the first encounter with a British Airways target of opportunity (BA-40665) recorded May 19, 2000 aboard N40 in Frankfurt Germany, using the Baseline Enhanced Decoder for comparison with the LPDU reception performance.

Next, in response to Action Item 9-7, John presented Working Paper WP-11-05, which presented the results of conducting the Combined Preamble and Data Block Tests with Multi-Level Mode A/C Fruit using the RMF Enhanced Decoders and LDPU.

Next, in response to Action Item 9-4, John presented Working Paper WP-11-10, which presented the 8th draft of the Enhanced Surveillance Processing Test Procedures. Working Paper WP-11-10 contains a revised draft of proposed enhanced surveillance processing test procedures based on Action Item 9-4, which requested that the Enhanced Test Procedures be revised to perform tests at 12 dB above MTL. And, in addition, this Working Paper revised the test procedures to run the Mode A/C fruit tests with the fruit at multiple levels.

During Working Group discussions of the results of WP-11-10, the Working Group ***agreed*** to make changes to Table 2-5, which has already been changed twice before in accordance with Working Papers WP-6-02 an WP-6-03. The change ***agreed*** to during this meeting revolved around the fact that the Working Group has previously ***agreed*** that the only equipment certified under DO-260A would require the use of "Enhanced Reception." Therefore, the changes made to Table 2-5 during Meeting 11 were to:

- remove the rows for A_2 and A_3 equipment using the "Standard" reception technique,
- rename the equipment classes previously named A_{2E} and A_{3E} to A_2 and A_3 respectively,
- change the "Reception Technique" required for A_1 equipment to "Enhanced,"
- change references from DO-242 to DO-242A, and finally,
- remove reference to MS-P in the table as well as in the *Note* following.

It was pointed out that the remainder of Section 2.1 would benefit from a review of proposed changes, taking into account the fact the DO-242A does not define any "Partial" State Vector or Mode Status Reports, as referenced in Tables 2-3 and 2-4. Additionally DO-242A now defines a Class B0 equipment class that needs to be defined and added to all relevant tables.

The act of making changes Sections 2.1 and 2.2.4.3.1.2 led the Working Group to a discussion on how to track changes to DO-260 going forward. Up to now, Gary Furr has maintained a table of changes that is posted on the ADS-B/1090 web site. Those PDF files posted there identify with change bars, strikethrough and highlighting text that has been deleted, changed or created in the respective sections. However, as was evident during Meeting 11, the Working Group going forward will find numerous instances where a discussion will lead to a requested change in the document that has not previously been documented with a Working Paper. It was ***agreed*** by the Working Group that going forward, if changes are made in real-time during a meeting, the changes will be documented in the minutes (as above), to the degree possible, and that a history will continue to be maintained where possible with change bars, strikethrough and highlighted text after the meeting.

A discussion also followed regarding the use of change bars, strikethrough and highlighted text in the final review copy of DO-260A as it goes to SC-186 for review. As has been pointed out numerous times by Stuart Searight, Gary Furr and James Maynard, it is simply not possible to maintain a document the size of DO-260 (900 pages) with Microsoft WORD and use the "Track Changes" feature without running a significant risk of having WORD crash and potentially loose a portion of your document. Vince Orlando and Bill Harman volunteered to investigate whether or not there might be a tool that would run a compare on the final draft DO-260A product against the original DO-260 to produce a change history. Again, as was pointed out by Gary Furr, the changes required by the addition of Enhanced Processing, TIS-B, NIC/NAC/SIL, SV/MS/OC Report restructuring and many other DO-242A required changes, along with hundreds of editorial changes would make the resultant document unreadable.

7. As a part of Agenda Item 7 dealing with material on Enhanced Processing, Vince Orlando briefly discussed Working Paper WP-11-07. In view of other Working Papers presented during Meeting 11, Vince requested that WP-11-07 be withdrawn and that it will be rewritten and presented at Meeting 12.

8. In conjunction with Agenda Item 9, the Working Group began the consideration of Working Paper WP-11-09 that was originally presented as 1090-WP-8-07 in response to Action Item 7-3. WP-11-09 presents some suggestions for the TIS-B Ground Architecture.

9. Vince Orlando continued with TIS-B materials and presented Working Paper WP-11-08 that was originally presented as 1090-WP-8-04 in response to Action Item 2-16. WP-11-08 presents a proposal for adding a TIS-B Management Message Format, based on a preliminary reading of the Draft TIS-B MASPS that is now available from RTCA for a review by SC-186 at the Plenary in June 2002. The Working Group agreed that a decision to continue forward with the proposal to create TIS-B Management Messages will be deferred until Meeting 12, which is after the SC-186 Plenary reviews the TIS-B MASPS in the June Plenary.

10. Bill Harman began the review of Working Paper WP-11-12, which presents the second draft of proposed materials for TIS-B Message Processing and Reporting, beginning with Section 2.2.17.4 through the end of Section 2.2.17. Bill agreed to accept **Action Item 11-05** to continue to update the proposed text based on comments received during this meeting, and to present it again at Meeting 12.

11. Finally, under Agenda Item 11, Vince Orlando presented Working Paper WP-11-11. This Working Paper raised a question received from industry on the coding of the Vertical Rate and Geo Altitude Difference from Baro Fields. The key question is the whether or not it is intended that the input data for these fields be rounded before encoding. After reviewing a response received on this Working Paper from Bob Saffell of Rockwell Collins, the Working Group ***agreed*** to accept Bob's proposed solution to the problem and the following two changes were made during the meeting:

    - Change the last line of the last paragraph under Step 3 of Section 2.4.3.2.6.1.12 from "an even multiple of 64 feet/minute." **to** "an integer multiple of 64 feet/minute with an accuracy of +/- 32 feet/minute."

    - Change the last line of the last paragraph under Step 3 of Section 2.4.3.2.6.1.15 from "an even multiple of 25 feet." **to** "an integer multiple of 25 feet with an accuracy of +/- 12.5 feet."

12. The following **Action Items** were identified at this, or previous, meetings of this Working Group. The asterisk (*) beside a name or organization indicates that they are the lead for the resolution of that Action Item. Actions shown here are those Action Items that remained OPEN at the end of this meeting.

Action Number	Action Description	Assigned to	Status
8-1	Provide the results from testing with the directional 1090 MHz receive antenna. (Flight Tests scheduled for 24-25 April 2002 had an LDPU problem. This may be delayed until Fall 2002)	Carl Jezierski	
9-6	Investigate the confidence value parameter for the multi-sample technique without table lookup at 8 MHz sampling rate. Determine whether the new technique is compatible with an 8 MHz rate.	Bill Harman	

Action Number	Action Description	Assigned to	Status
9-9	Write a test to verify that the sliding window error correction technique is not used.	Bill Harman Stacey Rowlan	
9-12	Add to Appendix D recommendations on when to use the TIS-B Coarse and Fine Formats.	Vince Orlando	
9-15	Simulate reception, using enhanced surveillance, with a 4 or 6 MHz bandwidth, and compare to the 8MHz bandwidth case.	Bill Harman	
10-2	WG-3 has agreed to delete the Aircraft Operational Coordination Message for the reason that there are no requirements in the ADS-B MASPS which required any of the parameters of the message. This action therefore is to review DO-260 and recommend all of the places where deletion of text is required to extract this message from the document.	Gary Furr	
10-3	Continue work on the Proposed Transmission Rate for the ID Squitter by analyzing the result if the ID Squitter is sent every 5 seconds.	Bill Harman	
10-5	Analyze the GPS data from Action Item 10-4 and report on the percent of time a stationary aircraft would be in the high transmission rate mode for thresholds of 5, 4 and 3 meters and recommend a threshold for DO-260A.	Bill Harman	
10-8	Propose text for Appendix I to accompany the diagram presented in WP-10-12, and specify location for the text and diagram in Appendix I	Bill Harman	
10-9	Provide John Van Dongen with the preamble detection / re-triggering algorithm being used by Jeff Gertz	Bill Harman	
10-14	Make updates to WP-10-15 (CC & OM Fields) as discussed during Meeting 10 and present at the next meeting.	Jim Maynard	
10-15	Align the proposed text changes in WP-10-09 and WP-11-01R1 (revised DO-260 for Intent) and WP-10-15 (CC & OM Fields).	Jim Maynard Ron Jones	
10-16	Reference WP-5-10A and make updates necessary to reflect final DO-242A requirements for NIC/NAC/SIL.	Jim Maynard	
11-01	Propose text for Appendix I to insert into the end of the Re-Triggerable section, based on WP-11-02.	John Van Dongen	
11-02	Propose text for a test procedure for re-triggering.	John Van Dongen	
11-03	Update WP-11-10 (Enhanced Test Procedures) to include values for the A1 equipment class.	John Van Dongen	
11-04	Propose changes to DO-260A to show mapping between 1090 ES Messages and DO-242A required reports. See existing tables in Section 2.1.	Ronnie Jones	
11-05	Update and re-present at Meeting 12 the Working Paper 1090-WP-11-12, with comments from Meeting 11 for changes to TIS-B Message Processing and Reporting.	Bill Harman	

Action Number	Action Description	Assigned to	Status
11-06	Make further updates to text presented in WP-11-01R1 to take into account further changes discussed during Meeting 11.	Ron Jones	
11-07	Make modifications to the paragraph which was presented in WP-11-07 for Appendix I, taking into account that Center Sample performance is now required for Class A1.	Vince Orlando	

13. The **Working Papers** shown in the following table are specifically for the Meeting being reported in these Meeting Minutes. Working Papers for all WG-3 Meetings, as well as the Meeting Agendas, Meeting Minutes, Meeting Schedules and modifications to DO-260 for the production of Revision A, will be posted on the ADS-B 1090 MHz web site located at:
http://adsb.tc.faa.gov/ADS-B/186-subf.htm

Working Paper	Size	Description	Introduced At:
1090-WP-11-01R1	94KB	Proposed Enhancements to the 1090 MHz Extended Squitter MOPS, presented by Ron Jones, FAA, ASD-140	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-02	17KB	RMF Enhanced Decoder Re-Triggering Algorithm Description, presented by John Van Dongen in response to Action Item 10-10	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-03	19KB	RMF Enhanced Decoder Re-Triggering Test Data, presented by John Van Dongen in response to Action Item 10-12	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-04	41KB	24 May 2000 Six-Minute Frankfurt Data Sample Processed with the RMF Baseline Enhanced Decoder with the New Re-Triggering Algorithm and the 6-Microsecond Post Trigger Dead Time, presented by John Van Dongen in response to Action Item 10-13	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-05	49KB	Combined Preamble and Data Block Tests with Multi-Level Mode A/C Fruit – Bench Test Data, presented by John Van Dongen in response to Action Item 9-7	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-06	126KB	Frankfurt May 19, 2000 British Airways Target Reception Data with RMF Baseline Enhanced Decoder, presented by John Van Dongen in response to Action Item 9-10	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-07	9KB	Proposed Revision of the Text on the Requirement for the Multi-sample Technique in Appendix I, presented by Dr Vince Orlando in response to Action Item 10-6	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-08	22KB	Proposal for a TIS-B Management Message Format, presented by Dr Vince Orlando, and previously presented as 1090-WP-8-04 in response to Action Item 2-16	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-09	21KB	Proposed TIS-B Ground Architecture, presented by Dr Vince Orlando, and previously presented as 1090-WP-8-07 in response to Action Item 7-3	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-10	62KB	Draft #8 of the Enhanced Surveillance Processing Test Procedures, presented by John Van Dongen in response to Action Item 9-4	Meeting 11, 5/14/2002 FAA Tech Center
1090-WP-11-11	7KB	Coding of the “Vertical Rate” and the “Geo Altitude Difference from Baro” Fields of the Airborne Velocity Message, presented by Dr Vince Orlando	Meeting 11, 5/14/2002 FAA Tech Center

Working Paper	Size	Description	Introduced At:
1090-WP-11-12	19KB	Draft of 1090 MOPS Material for TIS-B Message Processing and Reporting, Sections 2.2.17.4 to the end of 2.2.17, presented by Dr William Harman	Meeting 11, 5/14/2002 FAA Tech Center

14. As per Action Item 4-7, a review of DO-260 was accomplished and the following table of open, or unresolved, issues was generated, along with two issues defined during Meeting #4. WG-3 members should review this list and ensure that there are not other issues known to them that should be on this list. This list will be review at each future meeting for addition or deletion of items.

Issue #	Issue/Question Description	Raised by	Date Raised	Status
1	DO-260 Table 2-11 in Section 2.2.3.2.3.1, NUC_P code for Type Code=22 is still shown as ***TBD***	Gary Furr	15 May 01	
2	DO-260 Table 2-30 in Section 2.2.3.2.6.1.13, "Turn Indicator" coding is still ***TBD*** and the implementer is directed to set the code to ZERO until further notice. If this requirement is deleted, then sections 2.2.3.2.6.2.13, 2.2.3.2.6.3.13, 2.2.3.2.6.4.13, 2.2.5.1.10, 2.2.5.1.15 and 2.2.8.1.19 must also be addressed, along with all of their section 2.4 mates. Also Appendix F, MASPS Ref #R.2.26.	Gary Furr	15 May 01	
3	DO-260 Table 2-43 in Section 2.2.3.2.7.1.4, the "TCP/TCP+1 Data Valid Subfield" was declared not to be useful during the June 2000 Plenary and the field was declared to be "reserved" and set to ZERO in the initial version of the MOPS. Section 2.4.3.2.7.1.4 only tests for the case where the code is set to ZERO. Until this field has validity, no TCP data will be considered valid! All sections relating to TCP/TCP+1 were left as written in the initial DO-260.	Gary Furr	15 May 01	A Note is being added to 2.2.3.2.7.1 to state the status of TCP in DO-260A assuming no changes.
4	Sections 2.2.3.2.7.3.3.1 through 2.2.3.2.7.3.4.4 defining both the "Capability Classes" and the "Operational Mode" of the Aircraft Operational Status Message, including Tables 2-54 through 2-61 are full of ***TBD***s. Also affects Appendix F, MASPS Ref R2.31 and R2.32.			
5	DO-260 Table 2-67 in Section 2.2.8.1.5, the "NUC_P Coding Requirements" contains numerous ***TBD***s.	Gary Furr	15 May 01	
6	DO-260 Table A-2 in Section A.4.1, NUC_P code for Type Code=22 is still shown as ***TBD***	Gary Furr	15 May 01	
7	DO-260 Section A.4.9.4 was never altered after the June 2000 Plenary which declared the "TCP Data Valid" subfield to be 'reserved' and hard wired to ZERO in the initial DO-260.	Gary Furr	15 May 01	
8	Sections A.4.11.3 through A.4.11.10 defining the CC_4, CC_3, CC_2, CC_1, OM_4, OM_3, OM_2 and OM_1 Operational Capabilities and Statuses are full of ***TBD***s	Gary Furr	15 May 01	
9	Appendix F, Ref. #R2.38, the effective coverage of the ground receiver is still ***TBD***.	Gary Furr	15 May 01	

Issue #	Issue/Question Description	Raised by	Date Raised	Status
10	Implementation of the Working Papers WP-4-03 and WP-4-06 for TCAS RA, are pending a decision by the Ad Hoc MASPS Working Group on the requirement.	WG-3	15 May 01	
11	Address the issue of whether or not to write a requirement into Section 2.2 of DO-260A for using the "Conservative Error Correction Technique."	WG-3	15 May 01	
12	Clarify the need to transmit current TCP/TCP+1. In particular the need to comply in the Test Procedures, in view of the fact that the Data Valid Flag is currently set to zero (0) in DO-260	WG-3	21 Aug 01	
13	Additional changes will need to be made to Tables 2-3, 2-4 and 2-5, and potentially other places in DO-260, if SC-186 approves changes suggested by WG-6 to DO-242A to eliminate the Partial Mode Status Report (MS-P), only produce a standard MS Report, and to put all TCP information into a newly defined "On-Condition" Report.	WG-3	18 Oct 01	